CLAIMS

1. A method of examining a sample, comprising:

exposing a reference to a first set of electromagnetic radiation to form a second set of electromagnetic radiation scattered from the reference;

exposing a sample to a third set of electromagnetic radiation to form a fourth set of electromagnetic radiation scattered from the sample; and

interfering the second set of electromagnetic radiation and the fourth set of electromagnetic radiation;

wherein the first set and the third set of electromagnetic radiation are generated from a source;

at least a portion of the second set of electromagnetic radiation is of a frequency different from that of the first set of electromagnetic radiation; and

at least a portion of the fourth set of electromagnetic radiation is of a frequency different from that of the third set of electromagnetic radiation.

2. The method of claim 1, further comprising

detecting fourth photons in the fourth set of electromagnetic radiation;

wherein the detecting comprises the interfering.

3. The method of claim 2, wherein the fourth photons are anti-Stokes photons.

4. The method of claim 2, wherein the fourth photons are Stokes photons.

5. A method of forming an image of a sample, comprising:

exposing a reference to a first set of electromagnetic radiation, to form a second set of electromagnetic radiation scattered from the reference;

exposing a sample to a third set of electromagnetic radiation to form a fourth set of electromagnetic radiation scattered from the sample;

forming a digital data set corresponding to the sample; and

converting the data set into an image;

wherein the forming of the data set comprises interfering the second set of electromagnetic radiation and the fourth set of electromagnetic radiation;

the first set and the third set of electromagnetic radiation are generated from a source;

at least a portion of the second set of electromagnetic radiation is of a frequency different from that of the first set of electromagnetic radiation; and

at least a portion of the fourth set of electromagnetic radiation is of a frequency different from that of the third set of electromagnetic radiation.

6. The method of claim 5, further comprising

detecting fourth photons in the fourth set of electromagnetic radiation;

wherein the detecting comprises the interfering, and

the forming of the data set comprises the detecting.

7. The method of claim 6, wherein the fourth photons are anti-Stokes photons.

8. The method of claim 1, wherein the electromagnetic radiation is in the frequency range of infra-red to ultraviolet light.

9. The method of claim 5, wherein the electromagnetic radiation is in the frequency range of infra-red to ultraviolet light.

10. The method of claim 1, wherein the examining of the sample is by optical coherence tomography.

11. The method of claim 5, wherein the forming of the data set is by optical coherence tomography.

12. The method of claim 1, wherein the sample is selected from the group consisting of a tissue sample, a single cell, and a patient.

13. The method of claim 5, wherein the sample is selected from the group consisting of a tissue sample, a single cell, and a patient.

14. The method of claim 12, wherein the sample is a human patient.

15. The method of claim 13, wherein the sample is a human patient.

16. In a method of forming an image by optical coherence tomography, including exposing a sample or patient to electromagnetic radiation, collecting scattered electromagnetic radiation, and forming an image from the collected electromagnetic radiation including interfering the collected electromagnetic radiation with reference electromagnetic radiation, the improvement comprising the reference electromagnetic radiation being scattered from a reference sample, and the wavelength of the collected electromagnetic radiation being different from that of the electromagnetic radiation that the sample or patient is exposed to.

17. In an optical coherence tomography device, including an electromagnetic radiation source for generating reference electromagnetic radiation and sample electromagnetic radiation, an optical delay line, a scanner, and a electromagnetic radiation detector, the improvement comprising a reference holder and optics adapted to expose the reference electromagnetic radiation to a reference before interfering the reference electromagnetic radiation with the sample electromagnetic radiation.

18. A device for examining a sample, comprising:

an oscillator,

a reference generator, optically coupled to the oscillator,

a sample illuminator, optically coupled to the oscillator,

an interferometric demodulator, optically coupled to the reference generator and the sample illuminator,

a recorder, coupled to the demodulator, and

a frequency-selecting element that ensures that the light that illuminates the sample is excluded from the modulator.

19. The device of claim 18, wherein the oscillator comprises a laser.

20. The device of claim 19, wherein the oscillator further comprises a pulse shaper or a chirper.

21. The device of claim 18, further comprising a scanner for scanning a sample, coupled to the sample illuminator.

22. A method of examining a sample, comprising:

exposing a sample to a first set of electromagnetic radiation to form a second set of electromagnetic radiation scattered from the sample; and

interfering the second set of electromagnetic radiation with a third set of electromagnetic radiation;

wherein the third set of electromagnetic radiation is coherent with the first set of electromagnetic radiation;

at least a first portion of the second set of electromagnetic radiation is of a frequency different from that of the first set of electromagnetic radiation; and

at least a portion of the third set of electromagnetic radiation is of the same frequency as the first portion of the second set of electromagnetic radiation.

23. The method of claim 22, further comprising

detecting second photons in the second set of electromagnetic radiation;

wherein the detecting comprises the interfering.

24. The method of claim 23, wherein the second photons are anti-Stokes photons.

25. A method of forming an image of a sample, comprising:

exposing a sample to a first set of electromagnetic radiation to form a second set of electromagnetic radiation scattered from the sample;

forming a digital data set corresponding to the sample; and

converting the data set into an image;

wherein the forming of the image comprises interfering the second set of electromagnetic radiation and a third set of electromagnetic radiation;

wherein the third set of electromagnetic radiation is phase-coherent with the first set of electromagnetic radiation;

at least a first portion of the second set of electromagnetic radiation is of a frequency different from that of the first set of electromagnetic radiation; and

at least a portion of the third set of electromagnetic radiation is of the same frequency as the first portion of the second set of electromagnetic radiation.

26. The method of claim 25, further comprising

detecting second photons in the second set of electromagnetic radiation;

wherein the detecting comprises the interfering, and

the forming of the image comprises the detecting.

27. The method of claim 25, wherein the second photons are anti-Stokes photons.

28. The method of claim 25, wherein the second photons are Stokes photons.

29. The method of claim 22, wherein the electromagnetic radiation is in the frequency range of infra-red to ultraviolet light.

30. The method of claim 25, wherein the electromagnetic radiation is in the frequency range of infra-red to ultraviolet light.

31. The method of claim 22, wherein the examining of the sample is by optical coherence tomography.

32. The method of claim 25, wherein the forming of the image is by optical coherence tomography.

33. The method of claim 22, wherein the sample is selected from the group consisting of a tissue sample, a single cell, and a patient.

34. The method of claim 25, wherein the sample is selected from the group consisting of a tissue sample, a single cell, and a patient.

35. The method of claim 33, wherein the sample is a human patient.

36. The method of claim 34, wherein the sample is a human patient.

37. In a method of forming an image by optical coherence tomography, including exposing a sample or patient to electromagnetic radiation, collecting reflected and scattered electromagnetic radiation, and forming an image from the collected electromagnetic radiation including interfering the collected electromagnetic with reference electromagnetic radiation, wherein the reference electromagnetic radiation is coherent with the light to which the sample or patient is exposed, and wherein at least a portion of the reference electromagnetic radiation is of the same frequency as the collected electromagnetic radiation, and detecting photons in the collected electromagnetic radiation, the innovation comprising the reference and the collected electromagnetic being of a different frequency than the light to which the sample or the patient is exposed.

38. An image formed by superimposing:

(a) an image formed by interfering a first set of CARS photons emitted by a sample with a second set of reference photons, wherein

the second set of reference photons are coherent with the first set of CARS photons;

(b) an optical coherence tomography image of the sample, wherein the optical coherence tomography is obtained with linearly scattered photons.

39. An image formed by superimposing:

(a) an image formed by interfering a first set of CSRS photons emitted by a sample with a second set of reference photons, wherein the second set of reference photons are coherent with the first set of CSRS photons;

(b) an optical coherence tomography image of the sample, wherein the optical coherence tomography is obtained with linearly scattered photons.